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*Archimedes: What Did He Do Besides Cry Eureka?* by Sherman Stein

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There is much happening these days in the world of Archimedes. We may at last get a new, complete, literal, English translation; new examinations of the now available palimpsest have already yielded interesting insights; most of all, scholars have made deep advances in recovering the traditions of his works and in understanding Archimedes' mathematical practice. For the rest of the world, perhaps this is more than is wanted. For them, Stein's book might serve. Its goal is to introduce those with high-school mathematics to Archimedes' accomplishments. It is traditional in that it makes full use of modern concepts and notations; it makes no attempt to put Archimedes in any mathematical context, nor does it seem aware of much recent scholarship. Though dedicated to Wilbur Knorr, it seems almost completely uninfluenced by his work. Inspired by the recent availability of the palimpsest, it nonetheless precedes the important work of Reviel Netz. So, with little exception, this is not a book for scholars. Is it then a book for the rest of us?

The book is brief and deals exclusively with a few of Archimedes' extant works. In are the *Equilibrium of Planes*, the *Method* (especially centers of gravity), the *Quadrature of the Parabola*, *Floating Bodies* (with a clear discussion on the stability of the paraboloid), the area of the spiral from *On Spirals*, the surface and volume of the sphere from *On the Cylinder and Sphere*, and the circumference of a circle from *Measurement of the Circle*. Out are other works and all non-extant works including the Cattle Problem, the traces of his astronomy, the construction of the regular heptagon, evidence for the book on the balance, trisection of the angle, and so forth. Given the

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purpose of the book, the only relevant question is whether it adequately introduces a reader to Archimedes, entertains her, and does not deceive her too much.

It does often entertain. Stein reprints a delightfully romantic and silly announcement of the discovery of the palimpsest from the *New York Times*. His development of the basic properties of parabolas from affine geometry is amusing, even if it has little to do with Archimedes' mathematics. Stein follows the more sceptical in his account of Archimedes' life (thus, the title turns out to be a joke), and so tells us little about his world. That is a pity, since he could have given the reader a little of the history of Syracuse and life in the third century BC.

Nonetheless, Stein makes good pedagogical choices in the arrangement of mathematical problems and in the introduction of new material. One gets a good picture of some highlights of what Archimedes proved and often a good sense of the proof strategy, albeit without getting any sense of what it is like to work in Greek mathematics or with Greek proportions (Stein treats ratios and fractions indifferently) and so forth. Perhaps this is enough for the beginner. Even a specialist might luxuriate in seeing the strategy and structure of arguments with their motivation clearly presented in standard, modern notion without the details.

The book comes with a rich collection of exercises without solutions, but occasionally followed by a discussion that gives a hint to the astute reader. With a few exceptions, the exercises are doable and enjoyable. The exceptions include one which Stein professes not to have solved, while some exercises contain trivial errors that the careless student might not notice: for example, on p. 108, the reader cannot show that  $\pi < 3.215$ , since this value has been rounded down from Archimedes' estimate  $\pi < 1836/571$ ; or on p. 70, the reader is required to show that one point is below another, which will not hold if the body is submerged. Only someone not versed in ancient mathematics can show [8] for two weights that  $W/w$  is rational (a fraction?) if and only if  $W$  and  $w$  are commensurable! Some exercises seem to require induction.

As an intelligent amateur, Stein makes some significant errors. For example, he does not see that the mechanical technique used for the quadrature of the parabola in the *Quadrature of the Parabola* is

very different from that of the *Method* [53–54] in its use of *reductio* by compression of areas. Stein [8] informs the reader that Archimedes would not multiply a weight by a length, but then falsely tells the reader that he would take the ratio of a weight to a length instead. Unfortunately, the reader unversed in ancient treatments of conic sections will find Stein's account of the parablola difficult unless she reads the appendix on affine geometry first. And some less significant ones. A little illiterate Greek is more silly than offensive [15]; but Stein propagates two common, yet curious misunderstandings about translation. He evidently thinks that manuscript copies and editions in Greek are translations. He also does not realize that Heath and Dijksterhuis are abridgements that include much paraphrase, and that neither is properly a translation of the text [x, 6, 32, 75]. There are a few malicious typos among the numbers in the measurement of the circle [111, 116].

In sum, this is an old-fashioned book that is nonetheless readable and often gives a good intuition of the proof strategy, yet with errors and a lack of breadth in covering the work of Archimedes.